

ASSOCIATION BETWEEN CARDIOVASCULAR AND INTRAOCULAR PRESSURE CHANGES IN A 14-DAY 6° HEAD DOWN TILT (HDT) BED REST STUDY: POSSIBLE IMPLICATIONS IN RETINAL ANATOMY

Ronita Cromwell, Susana Zanello, Patrice Yarbough, Robert Ploutz-Snyder, Giovanni Taibbi, Gianmarco Vizzeri

Visual symptoms and intracranial pressure increase reported in astronauts returning from long duration missions in low Earth-orbit are thought to be related to fluid shifts within the body due to microgravity exposure. Because of this possible relation to fluid shifts, studies conducted in head-down tilt (HDT) bed rest are being monitored for potential changes in ocular health. These measures will also serve to determine whether HDT is a suitable ground-based analog to model subclinical cardiovascular and ocular changes that could shed light on the etiology of the VIIP syndrome observed in spaceflight.

Sixteen healthy normotensive (12M, 4F, age range 29-54 years), non-smoker and normal weight subjects, volunteered to participate in a 14 day 6° head HDT study conducted at the NASA Flight Analogs Research Unit (FARU). This facility provides standard bed rest conditions (diet, wake/sleep time, time allowed in sunlight) during the time that the subjects stay at the FARU. Cardiovascular parameters were obtained in supine posture at BR-5, BR+0, and BR+3 and ocular monitoring was performed weekly.

Intraocular pressure (IOP) increased from pre-bed rest BR-3) to the third day into bed rest (BR+3). Values reached a plateau towards the end of the bed rest phase (BR10) and decreased within the first three days of recovery (BR+2) returning to levels comparable to baseline at BR-3. As expected, most cardiovascular parameters were affected by 14 days of HDT bed rest. Plasma volume decreased as a result of bed rest but recovered to baseline levels by BR+3. Indications of cardiovascular deconditioning included increase in both systolic and diastolic blood pressure and heart rate, and a decrease in stroke volume and cardiac output between BR-5 and BR+3. Due to the experimental design of this study, we were not able to test the hypothesis that fluid shifts might be involved in the IOP increase during the bed rest phase, since cardiovascular measures were not available for those time points. There was no correlation between the largest change in IOP (BR-3 versus BR3) and cardiovascular measure changes between baseline (BR-5) and post bed rest (BR+2).

While no clinically relevant visual changes were observed during the study, measurement of various retinal parameters was performed with optical coherence tomography (OCT). A decrease in central subfield retinal thickness was observed between BR+2 and baseline at BR-10, but no association was observed with IOP changes.

This work investigates the time course of changes in IOP during 14-day HDT bed rest in an attempt to characterize HDT bed rest as a model of the VIIP syndrome and delve into its etiology.